An Interim Review of Nine UMTA-Assisted Joint Development Projects

October 1983

NOTE: This report is one of a series of analyses designed to explore the potential of innovative funding options and approaches for transit. Part of its content includes policy and program recommendations based on this contractor's perception of the issues involved. Recognizing that there may be other alternative approaches to resolving transportation problems, these positions may not necessarily reflect those of the U.S. Government. As such, no endorsement of these recommendations is either expressed or implied by the U.S. Department of Transportation.

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Summary Report
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Executive Summary

System interface and joint development projects represent potentially significant revenue sources for mass transit operators whether those operators provide only all-bus service or rapid transit and commuter rail services as well. As the terms are used in this report, "joint development" is basically real estate development that is closely linked to public transportation services and station facilities, often involving the use of air rights above them, and providing pedestrian access via underground passages, surface routes or skyways; "system interface" is a direct physical connection between a transit station and an adjacent property usually added at some point after a station has been built, and is usually not part of a joint development project, per se. In both cases, because the value of integral and adjacent real estate property is increased by the presence of the transit facility, it has become generally accepted that transit operators should equitably share some part of that value enhancement through the concept of "value capture."

The purpose of this report, which deals only with joint development and not with system interface projects, is to assemble and analyze possible indicators of the relative success of nine joint development projects begun under the former Urban Initiatives Program with Urban Mass Transportation Administration (UMTA) funding assistance. The projects are located in Baltimore, Boston, Buffalo, Cambridge, Cedar Rapids, Davenport, Miami, Philadelphia, and Santa Ana, California. Since none of the projects has yet been completed, "success" is projected in terms of the principal benefits expected to accrue to transit operators and thus to the UMTA assistance program. These benefits include induced net additional transit ridership and farebox revenues, and earmarked proceeds from the sale or lease of joint development property.

A major research finding is that the projected transit ridership and farebox revenues associated with the nine projects could be extremely significant. For the first full year following completion of all projects, daily ridership could range up to 50,000 one-way trips, and annual ridership up to nearly 12,000,000 one-way trips. Daily farebox revenues could reach $34,000, and annual farebox revenues well over $9,000,000. This net additional farebox return would be sufficient to "repay" UMTA's $49.5 million

investment in the projects in less than six years.

Another major research finding is that UMTA's cost for inducing such ridership will be only $1,000 to $2,000 per net additional daily transit trip. This ratio, one of the cost-effectiveness indicators used in "alternatives analyses" of potential UMTA investments in large system improvement projects, is significantly lower than found in most other kinds of UMTA Section 3 capital assistance grant investments examined. For the first 31-mile segment of Washington's new METRO rail system, for example, the capital cost to UMTA was at least $14,000 per net additional transit trip, and about the same cost was experienced for the first 15-mile segment of Atlanta's new MARTA rail system. More than a dozen other proposed rail rapid transit investments would cost from about $5,000 to more than $30,000 per net additional daily transit trip. These costs per new rider would be higher still were operating costs included in the comparisons, so that joint development's investment superiority is generally understated.

Other research findings include:

o UMTA's $49.5 million investment leveraged another $103.1 million of public investment and well over $700 million of private investment. Leverage ratios as high as 44:1 were recorded.

o UMTA grant applicants indicate that the nine projects will create between 27,000 and 32,000 new permanent jobs. Together with the temporary employment linked with construction activities, this will be a powerful boost to the city economies.

o The 9.7 million square feet of floor space provided will yield a net increase of almost $17 million in annual property taxes. Proceeds from the sale or lease of joint development property, earmarked for transit system improvements, will run at least $1 million annually, and probably much more. Because many of the financial arrangements have not yet been completed, the final figure could run twice this amount.

o In general, the larger projects, as measured in terms of total investment and floor space added, seem likely to be the most successful. The evidence suggests, however, that even small joint development projects can represent an excellent UMTA investment.

Looking ahead, a number of steps can be taken by UMTA to assure that future joint development projects, funded from the conventional UMTA Section 3 capital assistance program,

will be even more successful. Guidelines based on the experience to-date can help applicants submit information from which UMTA will be able to make the best possible selection from among alternative potential projects.

In summary, participation in joint development projects such as reviewed in this report holds promise of substantial financial payoffs both for UMTA and for transit operators. The accumulated experience from a growing number of successful projects appears to be allaying the concerns of most transit operators and real estate developers, and an UMTA program to further encourage such public sector - private sector partnerships would seem most timely. Project selection criteria can be strengthened to meet UMTA budget constraints, and assure even more successful projects in the future.

An Interim Review of Nine UMTA-Assisted Joint Development Projects

Introduction

As the term is used in this report, "joint development" is real estate development that is closely linked to public transportation services and station facilities, and takes advantage of the market and locational benefits provided by them. Such joint development often involves the use of air rights over transit stations and terminals, and may provide direct entrances to them, or less direct pedestrian access via underground passageways, surface routes or skyways. Regardless of the physical relationship between the public transportation and the private development components, joint development requires close cooperation and often contractual agreements among the private entities developing the real estate, public transit operators, and other public agencies.

By means of these agreements, both private sector and public sector participants benefit from joint development. The benefits may include a boost to the economic growth of the community, increased returns on investment by the developer, enhancement of urban design, cost efficiences in the construction of both the public and the private facilities, an opportunity to manage and control urban growth, increased patronage and farebox revenues for the transit operator, and the chance for a significant recovery -- or "value capture" -- of transit capital costs through the sale or lease of air rights by the transit operator or other sponsoring public agency. Most transportation professionals have long been familiar with the joint development concept, and generally praise its potential cost-effectiveness as a means of improving the viability of urban transit systems. Transit operators and real estate developers now increasingly accept the mutual advantages of working together on joint development projects.

The Urban Mass Transportation Administration (UMTA) first gained the authority to help fund joint development projects with the adoption of the "Young Amendment" to the Urban Mass

Transportation Act of 1964. That authority was further expanded by amendments contained in the Federal Public Transportation Act of 1978. An additional means to assist cities make those incremental investments in transit facilities that would attract private development, allowing joint development projects to be implemented more efficiently, was provided by the former Urban Initiatives Program, started under the Carter Administration, but discontinued under the Reagan Administration. This Program actively encouraged the development of new downtown shopping malls, office and apartment buildings, and other kinds of real estate projects related to transit facilities. A number of joint development projects were started under the Program in 1979-1980, and some are moving toward completion in the near future.

The purpose of the present report is to assemble and analyze possible indicators of the relative success that may be achieved by nine of these UMTA-assisted projects. Ranging from relatively modest to extremely ambitious, with total public and private capital investments for individual projects running from around $19 million to as much as $358 million in 1979-1980 dollars (exclusive of UMTA's Section 3 capital investment in the basic transit facility improvements themselves), the projects are located in or near the downtown areas of Baltimore, Boston, Buffalo, Cambridge, Cedar Rapids, Davenport, Miami, Philadelphia, and Santa Ana, California. Short descriptions of the projects are provided below, but readers are cautioned that project information dates from early 1982, and that some projects may have since been somewhat modified. Such modifications will not affect the general conclusions reached in the research.

The relative success of the projects is specifically projected in terms of the benefits expected to accrue, since none of the projects are as yet completed, more or less directly to the transit operators in the project cities. The overall success of the projects -- that is, whether they will be profitable to real estate developers, and whether they will achieve non-transit system related objectives -- is not addressed. From the transit operator's standpoint, the principal benefits include induced transit ridership and farebox revenues associated with land use activities within the joint development projects, proceeds from the sale or lease of joint development property, and proceeds from real estate and related taxes. Although these benefits can only be projected at this point in time, they serve to provide some useful cost-effectiveness comparisons to other transit system capital investments.

To this end, the report contrasts the estimated cost per

net additional transit rider attributable to (1) the UMTA investment in the joint development projects, exclusive of its investment in the related transit system improvements themselves, such as the construction of a bus terminal or the reconstruction of a rapid transit station, and (2) the UMTA investment in new rapid transit systems, extensions of existing systems, or the acquisition of new rolling stock. Although the analyses must be considered preliminary and range-finding -- rather than final and precise -- the comparisons suggest that UMTA's investment in joint development projects is likely to be more cost-effective in terms of benefits accruing to transit operators than is its investment in many, more conventional, system improvement projects. In turn, this implies that higher priority might be given to using UMTA Section 3 capital assistance grants for joint development projects.

Brief Descriptions of the Nine Projects

The following paragraphs provide thumbnail physical descriptions of the nature and location of the subject projects. Additional quantifiable project attributes are found in various tables throughout the text.

o Baltimore - The "Lexington Market Station Joint Development Project" is a multi-level commercial complex consisting of retail, entertainment, and office uses adjacent to, and both functionally and physically integrated with, the Lexington rapid transit station, part of the new system under construction in Baltimore. The project site consists of about 175,000 square feet of land located at the "100 percent" corner of the downtown retail district. The project will result in the creation of between 25,000 and 40,000 square feet of pedestrian concourse interconnecting the mezzanine level of the new station and the private development project, up to 631,000 square feet of speciality retail and/or department store space, 200,000 square feet of office space, up to 400 parking spaces, and a two-block extension of the Lexington Street Mall.

o Boston - The "South Street Transportation/Air Rights Development Project" revolves around the renovation of an existing and historic railroad station, and the use of air rights above it. The station will become a new, consolidated Amtrak and regional rail terminal, a regional commuter bus terminal, and an intercity private carrier bus terminal. It will have a second-story walkway uniting the pedestrian flow

from and through the entire complex, connected with a reconstructed mezzanine lobby area of the Red Line subway station. Over the platform area will be a mid-rise office tower of 400,000 square feet; a 24-story, 600-room hotel tower; and a low-rise development parcel of about 250,000 square feet for high-technology uses.

o Buffalo - The "Buffalo Convention Center Hotel Joint Development Project" calls for a 400-room hotel incorporating a retail spine of 40,000 square feet, a corporate headquarters building for a local savings bank containing 400,000 square feet, and a smaller office building containing about 200,000 square feet. Covered walkways will connect the hotel with the existing downtown Buffalo Convention Center and the governmental complex (City Hall, court buildings, and county government offices) at Niagara Square. The project is located at the northern end of the Light Rail Rapid Transit Mall, and a rapid transit station will be located in the approximate center of the project. The site is within walking distance of the downtown shopping area and theatre district.

o Cambridge - The "Cambridge Center/Kendall Station Joint Development Project" is seen as the centerpiece for the remaining 24 acres of undeveloped land in the Kendall Square Urban Renewal Project area. It will consist of over 2.4 million square feet of office, hotel, retail, housing, light industrial, and public open space uses. The entire development will be directly served by, and integrated with, a modernized Kendall Square subway station. Although formerly a depressed industrial area, the site is now regarded as the gateway to Cambridge from downtown Boston, located immediately across the Charles River via the Longfellow Bridge.

o Cedar Rapids - The "Cedar Rapids Ground Transportation Center Joint Development Project" is essentially an intermodal bus terminal serving both urban and intercity buses, with air rights development above the new terminal. Retail uses will occupy parts of the first and second levels, with housing and office space added in two towers above the second level. The entire multi-use facility will be contained within a single block in the downtown area, and fully integrated with other downtown development, including a street-level connection with a proposed shopping mall (not part of the initial project).

o Davenport - The "Davenport Ground Transportation Center Joint Development Project," sometimes called "Super Port," involves the construction of another intermodal transfer facility, with coordinated hotel, parking, and community

college uses. The 3.9 acre site includes space for 15 city and 10 intercity buses, a 230-room hotel with associated retail and office space, a 500-space parking garage, and office, classroom and laboratory facilities for a community college branch. It will be located within one block of the "100 percent" corner of the central business district.

o Miami - The "Overtown Joint Development Project" involves the acquisition and clearance of four blocks immediately west of Miami's proposed New Washington Heights rapid transit station, and the construction of about 130,000 square feet of office, retail, hotel, and residential uses integrated with the station. It is part of a comprehensive redevelopment plan for revitalizing the nearby low-income Overtown community. The new rapid transit station and associated development will be the first rapid transit stop north of the busy Government Center station, and within walking distance of the Miami central business district.

o Philadelphia - The "Gallery II and Gallery III Joint Development Project" is a continuing phase of the Market Street East retail revitalization project in downtown Philadelphia. Gallery I, an urban shopping mall, was opened in 1977. Gallery II and III will contain about 1,550,000 square feet of office space in two high-rise towers, and about 631,000 square feet of retail space. There will be an adjacent 4,000-space parking structure. The whole complex will rise above a portion of the 1.8 mile rail tunnel linking the Reading Lines with the former Penn Central commuter lines, and will be directly accessible from remodeled 8th Street and 11th Street subway stations. An entrance to the Lindenwold rapid transit line is nearby.

o Santa Ana - The "Transit Center Joint Development Project" is the second phase of a Santa Ana Transportation Center (the first phase was a 475-car park-and-ride structure adjacent to the terminal). It consists of an intermodal terminal, with 15 urban bus berths and 4 intercity bus berths, and about 15,000 square feet of office space in a building above the terminal.

Research Methodology

Much of the information for this research was taken from grant applications received by the UMTA Office of Planning Assistance under the Urban Initiatives Programs in 1979-1980. These original applications, and certain supplementary

information submitted soon afterwards, obviously were based on the sponsors' initial expectations for the completed projects -- their best estimates of the quantities and mixes of floor space, the possible proceeds accruing to them from the subsequently-negotiated sale or lease of real property and air rights, the number of transit tripmakers attracted, and so forth. For various reasons, the nature of several projects changed somewhat with time, so that it was necessary to confirm and to update, as much as possible, certain basic information. This was accomplished in early 1982 through telephone conversations with local joint development project managers and others. In some cases, however, certain requested information remained unavailable because projects had still not yet advanced to more definitive stages. This did not prove to be a problem, for reasons that will become clear in reading the report.

For the purpose of the research, ridership and revenues were nevertheless completly re-estimated. This was deemed necessary because (1) the quantities and mixes of floor space initially proposed for some projects were variously changed after applications were submitted, but without accompanying revisions of expected ridership and revenues being submitted by the applicants, (2) ridership and consequent revenues were inconsistently estimated in the original applications in any case, sometimes being provided for an area larger than the joint development project area itself (such as for the whole "traffic zone" containing the project), and sometimes being provided for a horizon year well beyond the completion date of the project (such as for the year 2000), and (3) ridership and revenues did not always seem based on rigorous trip generation analyses, for example, office building trip generation usually deriving work trips from estimated employment, but failing to account for non-work trips by office building visitors. Appendix A to this report describes the assumptions and procedures used in making the new transit ridership and revenues estimates.

Report Organization

For simplicity of presentation, this report is organized around the transit-related benefits and costs associated with the projects. Certain benefits and costs are not discussed. Among them are benefits such as transportation energy savings and improvements to air quality resulting from increased transit ridership and decreased automobile usage, and costs such as traffic and transit service disruption during

construction, or relating to the displacement and relocation of existing uses on joint development sites. Readers will recognize that certain other benefits and costs may also be omitted. In effect, only those benefits and costs directly relating to the development of some preliminary "formula" for rating the relative success of the projects from the standpoint of UMTA and transit operators, and for comparing UMTA investment in joint development versus more conventional transit system improvement projects, are considered in this report.

Following the discussion of benefits and costs, the report draws some conclusions about the expected relative success of the nine projects. Order-of-magnitude comparisons to other UMTA capital investments, actual and proposed, are then presented in order to illustrate the fact that joint development projects generally provide UMTA as well as many transit operators with attractive investment opportunities. Finally, the report offers a number of suggestions for ways that UMTA, transit operators, and other joint development grant applicants might improve the chances of success for future projects.

Discussion of Benefits

Induced Transit Ridership

Throughout this report, the term "induced transit ridership" refers to the number of daily one-way transit trips generated by the activities contained within the joint development projects upon their completion. The term "induced net additional transit ridership" refers to the net increase in daily one-way transit system tripmaking attributable to the joint development projects, recognizing that not all of the trips generated by the projects will be new trips, but that some will simply have been "transferred," or shifted, from previous origins and destinations. Because the estimation of net additional tripmaking involves even more uncertainty than the estimation of total transit trips generated at the project sites, net additional transit tripmaking is expressed as a range of possible tripmaking, from a likely minimum to a likely maximum. This range is established judgmentally.

Developing the true net change in transit system ridership

that might result from the completion of the nine joint development projects clearly would require extensive before-and-after origin-destination surveys. The net change might, however, fall toward the high end of the established range because:

o Most of the nine projects have been started on sites that were either previously vacant or located in low-density, deteriorating areas. Existing transit ridership to such sites can thus be assumed to be minimal.

o Most projects represent, according to the grant applications, net new additions to downtown development, and not just a shift of activities from other parts of downtown or the suburbs. Even though this seems somewhat unlikely, if it were true, then all of the transit ridership generated by the projects would be new ridership. Whether or not the joint development projects represent net activity additions to the affected downtowns cannot, of course, be proved or disproved, but reasonable credence must be given to the grant applications on this score.

o Moreover, even had the equivalent amount of activity been undertaken elsewhere within the project cities, it can be argued that such activities would have been scattered among many locations, perhaps largely in the suburbs, quite possible generating no new ridership at all.

TABLE 1

SUMMARY OF ESTIMATED TOTAL DAILY TRANSIT TRIPS GENERATED AT NINE JOINT DEVELOPMENT SITES

City	Floor Space*	Trips**
Baltimore	831,000	8,900
Boston	1,250,000	6,454
Buffalo	1,040,000	4,390
Cambridge	2,255,000	15,533
Cedar Rapids	215,000	750
Davenport	280,000	1,200
Miami	1,130,000	3,618
Philadelphia	2,350	18,935
Santa Ana	70,000	312
Totals	9,716,000	60,092

* Thousands of square feet of interior space.
** Total one-way trips to and from the site on a typical weekday.

Transit trip generation by the nine joint development projects is thus discussed in two steps: the first describes the total transit ridership induced, regardless of whether it is all-new or in part simply shifted from other origins and destinations; the second decribes the range of net additional transit ridership created, allowing for the fact that at least part of the total ridership will, indeed, have been shifted. In both cases, ridership is expressed as the number of one-way transit trips made on a typical weekday, either to or from the joint development sites.

Table 1 thus summarizes the total transit ridership likely to be associated with each of the nine projects if all that tripmaking were new trips (disaggregation by floor space category and by peak/off-peak periods is included in Appendix Table 1A). Although Table 1 and Appendix Table 1A are basically benchmarks, since net additional transit ridership is used in most subsequent analyses, still they provide useful scaling devices from which certain preliminary conclusions can be drawn:

o The size of the individual projects varies greatly: from Santa Ana's 70,000 square feet (SF) to Philadelphia's 2,350,000 SF. The SF figures are considered to represent usable interior space, and exclude pedestrian malls and commonly used open space, as well as space devoted to transportation terminal uses, since such areas arguably are not trip generators in themselves.

o The total number of transit trips generated therefore also varies greatly: from Santa Ana's 312 trips daily to Philadelphia's 18,935 trips daily. Altogether, the nine projects may generate 60,092 daily transit trips, almost equally divided between peak and off-peak periods. Six of the projects may generate more peak than off-peak trips, while three projects may generate more off-peak trips -- the difference attributable to differing floor space mixes.

o In the sense of generating the greatest absolute number of both total transit trips and total off-peak transit trips, Philadelphia might be thought the most successful project.

o In the sense of generating the highest proportion of off-peak trips, however, Baltimore (81%), Davenport (70%), and Miami (68%) are each more successful than Philadelphia. With only 36 percent, Boston is the "worst case" in this respect.

o In the sense of generating the all-day modal split most favorable to transit, Philadelphia at 67 percent is the most

successful, closely followed by Cambridge at 65 percent. At 24 percent, Baltimore is the "worst case" in this regard (it should be especially noted that the estimated all-day modal splits shown in Appendix Table 1A are more reflective of the overall central business district modal splits in the nine cities than they are of the activity mixes within each project).

o Of the 9.7 million SF of interior floor space included in the nine projects, offices will account for 48 percent, hotels for 18 percent, retail establishments for 17 percent, residential development for 10 percent, light industry and high-tech establishments together for 7 percent, and the community college branch for less than 1 percent. In two projects, office space was substituted for residential development as plans firmed up, probably reflecting the then-tightening home mortgage and housing market.

o The 48 percent of office space accounts for 60 percent of the total transit generation; the 18 percent of hotel space for only 5 percent; the 17 percent of retail establishments for 27 percent; the 10 percent of residential use for 3 percent; the 7 percent of light industry and high-tech uses for 4 percent; and the community college branch for 2 percent.

o Retail use thus generates only somewhat more transit tripmaking per thousand square feet of space than does office use (9.8 trips per 1000 SF compared to 7.7 trips per 1000 SF). High-tech use generates just slightly less tripmaking per floor space unit than does office use, because while there is less space per employee, there are also fewer "visitors" to high-tech uses. Hotels and residential uses generate only 1.7 trips per 1000 SF. The community college branch is the greatest transit trip generator per floor space unit (33 trips per 1000 SF) largely because community college students tend to own fewer cars and have a greater propensity to use transit than do many workers and shoppers; college classrooms also tend to have a steady turnover of users throughout the day.

Although the detailed assumptions and procedures used to estimate total person trip generation by floor space category are described in Appendix A, it is important here to understand that such trip generation may be systematically underestimated. This is because there have been no definitive studies of person trip generation at new joint development projects of the types dealt with in this research; the basic person trip rates per thousand SF of floor space used in Appendix A are taken from general references on the subject where rates have generally been

established from studies of scattered, free-standing buildings and unit developments rather than from integrated multi-use developments such as joint development projects. It may be speculated that person trip generation rates at these newer multi-use projects may be higher, because of (1) the synergistic affects of placing amenable, well-designed, and often visually/emotionally stimulating multiple uses within short walking distances of each other, and (2) the superior transit system access afforded by structuring such uses around major transit terminals. If true, this may be another reason why the net additional transit tripmaking attributable to the nine joint development projects would tend to the high end of the estimated range (as discussed previously).

Nevertheless, it is clear that not all of the transit tripmaking summarized in Table 1 represents new tripmaking. Some proportion of those trips, with project by project variations, would simply be shifted from other origins and destinations. For the purposes of this report, the following assumptions were made about the proportion of "new" versus simply "shifted" person trips, and the higher propensity of shifted person trips to use transit to travel to and from the joint development sites: at the low end of the net additional transit ridership range, the assumption is that (1) three-fourths of the total person trips to the joint development sites are shifted from other locations, and that (2) those shifted trips have only a 20 percent higher probability of using transit than they had previously; at the high end of the net additional transit ridership range, the assumption is that (1) only one-fourth of the total person trips to the joint development sites are shifted trips, and that (2) those shifted trips have a 40 percent higher probability of using transit than they had previously. Although these assumptions are extremely simplistic, they serve to provide an explicit and easy-to-understand basis for estimating what might be considered the maximum, as against the minimum, net additional transit system ridership that can be credited to the joint development projects.

As shown in Table 2, if the more conservative assumptions are accepted as more likely, then the nine joint development projects would create about 22,000 new transit trips daily, or only about 37 percent of the approximately 60,000 trips shown in Table 1. If the more favorable assumptions are accepted as more likely, then the sites would create about 49,000 new transit trips daily, or about 82 percent of the 60,000 trips shown in Table 1 (Appendix Table 2A provides a further breakout of net additional ridership by land use category and peak versus off-peak tripmaking).

TABLE 2

SUMMARY OF ESTIMATED NET ADDITONAL
TRANSIT TRIPS GENERATED
AT NINE JOINT DEVELOPMENT SITES

City	Range in Daily Trips Minimum - Maximum
Baltimore	3,337 - 7,310
Boston	2,418 - 5,302
Buffalo	1,644 - 3,606
Cambridge	5,819 - 12,759
Cedar Rapids	281 - 616
Davenport	450 - 985
Miami	1,355 - 2,970
Philadelphia	7,093 - 15,553
Santa Ana	117 - 256
Totals	22,514 - 49,357

Because of the nature of the assumptions, the proportions of new versus shifted trips are the same for each of the nine projects. In actuality, of course, the proportions of shifted trips would probably vary from project to project, depending on local circumstances such as project locations, activity mixes, accessibility relative to competing activities, and so forth. Some projects might therefore generate closer to the maximum number of new transit trips shown in Table 2, while others might generate closer to the minimum number.

To avoid introducing further speculation, no attempt was made to adjust for such possible variations, and the remainder of this report deals with that range of net additional transit tripmaking shown in Table 2. In most instances, however, in order to emphasize the potential of joint development to create greater transit system ridership, the maximum tripmaking figures are used.

Induced Farebox Revenues

The farebox revenues that may be collected as a result of building the nine joint development projects are directly a function of the ridership credited to those projects -- with some variations introduced by differences from city to city

in fare structures, seasonal changes in transit service provided, weekday versus weekend shopping patterns, and so forth. As general background to drawing conclusions about the more desirable joint development activities from a farebox revenue standpoint, the following might be kept in mind:

o In cities where peak period fares are higher than off-peak period fares, the average farebox revenue per office worker will be higher than that per retail shopper (and other off-peak period transit users) because a higher proportion of office worker trips will occur during peak periods.

o In cities with zone fares, the average farebox revenue per office worker will also be higher than that of other tripmakers because, on the average, work trips are longer and thus cross more zones.

o On an annual basis, however, the total farebox revenue per shopper trip may begin to approach and possibly exceed the total farebox revenue per office worker because shoppers make more weekend trips than do office workers.

TABLE 3

SUMMARY OF ESTIMATED TOTAL FAREBOX REVENUE
(IN 1982 DOLLARS) FROM TRANSIT TRIPS GENERATED
AT NINE JOINT DEVELOPMENT SITES

City	Daily	Annual
Baltimore	5,415 -	1,664,550
Boston	3,712 -	993,810
Buffalo	2,368 -	624,900
Cambridge	8,933 -	2,334,530
Cedar Rapids	225 -	59,100
Davenport	360 -	109,260
Miami	1,809 -	536,580
Philadelphia	18,780 -	5,026,450
Santa Ana	225 -	56,250
Totals	41,827 -	11,405,430

Table 3 is a summary of farebox revenues based on total transit tripmaking to the joint development projects regardless of whether those trips are new or shifted (Appendix Table 3A provides a further breakout by land use category). It is constructed by assuming daily-to-annual tripmaking conversion factors of 250 for offices, 270 for light industry and high-tech uses, 300 for the community

light industry and high-tech uses, 300 for the community college branch and residential uses, and 320 for hotels and retail establishments. These are largely judgmental factors and differ from the systemwide, all-trip-purpose comversion factors provided by the transit operators in the subject cities, which were usually in the 260 to 280 range. Full fares have been credited for all trips to the joint development sites on the assumption that such sites would not attract a large proportion of reduced-fare patrons such as school children or the elderly and handicapped. The indicated revenues are based on 1982 fare structures, even though it is likely that by the time the joint development projects are completed fares will have been increased, in some cases perhaps significantly. No adjustment was attempted to account for such possible change, so that the indicated revenues can be considered conservative.

The following benchmark conclusions can be drawn from Table 3 and its companion Appendix Table 3A:

o As with ridership, there is great disparity in the daily and annual farebox revenues attributable to the nine projects. On a daily basis, the range is from $225 (both Cedar Rapids and Santa Ana) to $18,780 (Philadelphia). On an annual basis, the range is from $56,250 (Santa Ana) to over $5 million (Philadelphia).

o Total annual farebox revenue could reach $11.4 million, almost sufficient to "repay" UMTA's $49.5 million investment in the nine projects within five years. Even allowing for various weaknesses in the research methodology, the cost-effectiveness of the investment seems without question.

o With 48 percent of the total floor space, offices would generate about 59 percent of the total annual revenue; with 17 percent of the floor space, retail uses about 30 percent; with 18 percent of the floor space, hotel uses only about 4 percent; and with 17 percent of the floor space, all other uses combined about 7 percent.

Table 4 summarizes the range of annual farebox revenues associated with the assumed minimum and maximum number of net additional transit tripmakers. Again it is clear that the largest projects produce by far the greater revenues -- Philadelphia's range of $1.8 million to $4.1 million a year being almost one hundred times larger than Santa Ana's range of about $21,000 to $46,000 a year. Totals for the nine projects are nevertheless impressive: conservatively, while the nine projects might generate annual revenues of at least $4.2 million, more optimistically, they might generate as much as $9.4 million annually. The former return could

"repay" UMTA's investment in ten years; the latter could "repay" UMTA's investment in about six years.

TABLE 4

SUMMARY OF NET ADDITIONAL ANNUAL FAREBOX REVENUE (IN 1982 DOLLARS) FROM TRANSIT TRIPS GENERATED AT NINE JOINT DEVELOPMENT PROJECTS

Baltimore	623,540 - 1,367,261
Boston	372,281 - 816,316
Buffalo	234,088 - 513,293
Cambridge	874,515 - 1,917,583
Cedar Rapids	22,139 - 48,545
Davenport	40,929 - 89,746
Miami	201,003 - 440,747
Philadelphia	1,882,908 - 4,128,726
Santa Ana	21,071 - 46,204
Totals	4,272,474 - 9,368,421

Ridership and Revenues Per $1,000 UMTA Investment

To look at induced ridership and revenues without considering the corresponding level of UMTA investment involved is, however, misleading. When these measures are expressed as a function of that investment, then it is obvious that smaller as well as larger projects can be cost-effective. Table 5 shows both total annual ridership and total annual revenues per $1,000 UMTA investment for each project (Appendix Table 5A shows comparable daily ridership and revenue ratios).

Ranked in this normalized manner on total ridership, Boston appears to have the most successful project, with the possibility of generating 576 annual transit trips per $1,000 UMTA investment. Davenport, with one of the more modest projects, has the second most successful project with 520 annual transit trips per $1,000 UMTA investment, followed by Cambridge with 507 and Philadelphia with 504.

Ranked in the same normalized manner on revenues, however, Philadelphia appears to have far and away the most successful project, generating $493 in annual fares per $1,000 UMTA investment. Boston generates about $331 and Cambridge about $292. Different fare structures in the different cities account for the shifted rankings on a fare versus a farebox

revenue basis: in the Boston region, for example, subway fares were taken at 60 cents per ride and bus fares at 50 cents per ride, whereas in the Philadelphia region, both subway and bus fares were taken at 70 cents per ride, and railroad commuting fares were taken at $1.92 per ride, the 1982 average fare (also, about 15 percent of the transit trips generated by Philadelphia's Gallery Place project were assumed to use commuter rail, as against only about 5 percent of the transit trips to Boston's South Street Station project assumed to use commuter rail).

TABLE 5

ANNUAL TOTAL RIDERSHIP AND FAREBOX REVENUE
(IN 1982 DOLLARS) PER $1,000 UMTA GRANT

City	UMTA Grant	Rider-ship	Reve-nue
Baltimore	12.5	219	133
Boston	3.0	576	331
Buffalo	6.8	171	92
Cambridge	8.0	507	292
Cedar Rapids	0.7	281	80
Davenport	0.7	520	156
Miami	6.9	156	78
Philadelphia	10.2	504	493
Santa Ana	0.7	111	80
Totals	49.5	300	231*

* Weighted Average

Table 6 summarizes the range of annual net additional ridership and farebox revenues per $1,000 UMTA investment (Appendix Table 6A shows comparable daily ridership and revenue ratios). The relative "success" rankings of the nine projects remains unchanged from Table 5 because the proportionate reduction for shifted trips is constant for every project (by the nature of the assumptions made). However, where Table 5 shows that all projects combined would average an annual farebox return of about $231 per $1,000 UMTA investment, Table 6 shows that more likely the return would be between $85 and $190 per $1,000 UMTA iivestment.

Although the "cost-effectiveness" of the projects shown in Tables 5 and 6 are somewhat the product of assumptions made regarding trip generation and modal split, as well as the variations in fare structures from city to city, still the rather wide range of ridership and revenue ratios per $1,000

UMTA investment suggests that UMTA might place greater importance on keeping the size of any future joint development grants more closely related to the total scale of those projects. The grants made to Buffalo and Miami for somewhat modest-scale projects, for example, are nearly as large as the grant made to Cambridge, a much larger-scale project. Not surprisingly, other things being equal, Cambridge would show up as the more "successful" project when appraised on the per-$1,000 UMTA investment basis.

TABLE 6

ANNUAL NET ADDITIONAL RIDERSHIP AND FAREBOX REVENUE (IN 1982 DOLLARS) PER $1,000 UMTA INVESTMENT

City	Ridership	Revenue
Baltimore	82 - 180	50 - 109
Boston	215 - 473	124 - 272
Buffalo	64 - 140	34 - 75
Cambridge	190 - 416	109 - 240
Cedar Rapid	120 - 230	30 - 66
Davenport	192 - 427	58 - 128
Miami	58 - 128	29 - 64
Philadelphia	189 - 414	185 - 405
Santa Ana	41 - 91	30 - 66
Totals	81 - 246*	85 - 190*

* Weighted Averages

Proceeds from the Sale or Lease of Property

Information about the proceeds from the sale or lease of joint development property is incomplete. Discussions with public agency project managers in early 1982 failed to produce much more detail than was contained in the UMTA grant applications. Aside from the fact that the projects were then still physically incomplete, there appears to be various reasons why such information is not available at an early stage of project development:

o Plans change - The total floor space and activity mixture of a joint development project can change even as construction begins, because joint development is a dynamic process that is highly responsive to market forces. Until

the last minute, planned apartments may become offices, additional floors may be added to a planned hotel, planned retail floor space may be doubled (or halved), recreational facilities may be dropped, and so forth. The exact amount of saleable/leaseable space remains uncertain until projects are virtually completed.

o Implementation timing changes - Over the several years needed to complete most joint development projects, the sequence of building construction may differ from what was first anticipated. For example, a third major office building, part of Philadelphia's Gallery III, is understood to be under construction ahead of the twin office towers to be built as part of Gallery II. Theoretically, this might alter the need for floor space to be provided in the subsequently built twin office towers (another aspect of how plans change).

o Property values and lease rates change - Predicting the sales price or per-square-foot lease rates of joint development property that will only come onto the market several years after the submission of a federal grant application is nearly impossible. Although tentative projections can (and are) made, some project managers, aware of competition, are understandably reluctant to publicize such projections.

All of these factors, usually in combination, apparently make it difficult to predict lease/sale proceeds before projects are completed. The experimental nature of the Urban Initiatives Program, and the relative haste (for competitive reasons) with which some grant applications were seemingly assembled, may also have contributed to the lack of sales/lease proceeds information in the present case.

Moreover, even had these projected proceeds been more complete, the language of the applications examined, as well as the responses of the project managers contacted, suggest that the share of such proceeds earmarked for transit was not yet clearly established. It appeared well understood conceptually that transit operators would share in "value capture," but the extent and timing of such sharing was generally vague.

Such limited information supports only the most limited and tentative conclusions. Perhaps the most important is that lease/sale proceeds accruing to transit operators as a result of UMTA-assisted joint development projects under the former Urban Initiatives Program will likely be far less significant as a source of additional income than will new farebox revenues. Even if it is assumed that the entire $49.5

million UMTA investment is recovered over a 40-year period -- the locally-avowed goal in Philadelphia at least -- net additional farebox revenues for the 40-year period could exceed that return by three to seven times. Table 7 shows such lease/sale proceeds information as was available when this research was done.

TABLE 7

ESTIMATED PROPERTY TAX AND LEASE/SALE PROCEEDS AND NUMBER OF JOBS CREATED BY NINE JOINT DEVELOPMENT PROJECTS

City	Annual Lease Proceeds	Annual Property Taxes	Permanent Jobs Created
Baltimore	30,000(a)	127	1500-6000
Boston	NA	3,000	3500
Buffalo	NA	1,200	2000
Cambridge	NA	3,300	8000
Cedar Rapids	70,000	570	900
Davenport	125,000(b)	262	450
Miami	NA	500	900-1000
Philadelphia	237,500	7,800	10000
Santa Ana	NA	100	NA
Totals (not meaningful)		16,859	27250-31850

(a) Or estimated one-time $1.5 million sale.
(b) Plus one-time $60,000 sale.
(c) Recovering UMTA investment over 40 years.

Should UMTA choose to make further grants from conventional Section 3 capital assistance funds for joint development projects, it should take steps to help ensure that transit operators share more fully and explicitly in the sales and lease of joint development property. Transit operators should also look to such projects as an important source of both farebox and non-farebox revenues, and more vigorously negotiate advantageous agreements -- too often they seem to think of themselves only as providing transportation services, and not as seeking "profit" in private sector activities, even when such profit-seeking is fully justified. In any event, the lack of information in this report concerning sales/lease proceeds should not be construed as suggesting that they are unimportant, or that they should not be particularly stressed in planning future joint development projects.

Property and Related Tax Proceeds

The projected net gain in property tax returns for the nine projects is expected to total about $17 million annually (see Table 7). Although this amount is double the farebox revenues projected in the grant applications examined, none of the applications suggest that some share of such proceeds be earmarked for transit operators or for specific actions that would enhance the future market for transit service (such as for transit-related land use development elsewhere in each city).

In making any future joint development grants, UMTA might wish to consider requiring that applicants establish an equitable means of dedicating some share of the net gain in property tax returns either for transit operators' unrestricted use or for use by other public agencies having transit system enhancement responsibilities. One means for accomplishing this, which has been suggested by others, is through the establishment of "transit benefit assessment districts" encompassing only the joint development site.

Several grant applications also cited as project benefits expected receipts from retail sales taxes, from business and occupation taxes, and even from local corporate and personal income taxes. To the extent that the nine projects create net gains in sales and employment, the returns from all these taxes would increase. The applications neither quantify the possible tax increases nor suggest that transit operators share in the net gain. It would seem appropriate nevertheless for both UMTA and transit operators to explore means of sharing in this usually neglected component of value capture.

Permanent Jobs Created

The net gain in permanent employment created by the nine projects, as estimated in the grant applications, is expected to be between 27,000 and 32,000 jobs (see Table 7). This seems extremely important in the present high-unemployment environment. Whether, in the absence of the joint development projects, these jobs would have been created

anyway is arguable. But even if they would have been, they would doubtless be less compactly located and more scattered, perhaps largely in suburban areas where they would support neither transit systems nor central business districts. As with net gains accruing from property and other taxes, the value of permanent employment created by joint development projects may also be a proper subject for value capture, but none of the 1979-1980 grant applications discussed this possibility.

Discussion of Costs

Public and Private Investment in the Projects

The nine projects represent an almost one billion dollar combined investment of public and private funds, or an average of over $100 million per project (in 1979-1980 dollars). Table 8 provides a summary from which the following points can be made:

TABLE 8

ESTIMATED PUBLIC AND PRIVATE INVESTMENT
(IN 1979 DOLLARS) IN NINE JOINT DEVELOPMENT PROJECTS

	Capital Investment (millions $)			
City	UMTA	Other Public	Private	Total
Baltimore	12.5	2.6	15-50	30.1-65.1
Boston	3.0	10.0	120	133.0
Cambridge	8.0	13.5	150	171.5
Cedar Rapids	0.7	1.9	16	18.6
Davenport	0.7	1.2	21	22.9
Miami	6.9	1.7	45	53.6
Philadelphia	10.2	47.8	250-300	308-358
Santa Ana	0.7	1.4	9.5	11.6
Totals	49.5	103.1	727.5 to 812.5	880.1 to 965.1

o UMTA's contribution to the projects, exclusive of its share of funding for the underlying transit system improvements, is

$49.5 million. The U.S. Department of Housing and Urban Development (HUD), the U.S. Economic Development Administration (EDA), and local public agencies provide another $103.1 million. Private investment at the point of grant application was put at between $728 million and $813 million.

o UMTA thus provides about 32 percent of the total $152.6 million public investment, but only about 5-6 percent of the total public plus private investment. Although HUD and EDA together provide a larger share of the total public funding than does UMTA, because the projects are all built around and integrated with various transit system improvements, it can nevertheless be convincingly argued that the one billion dollar investment would not have been possible without UMTA participation.

o The $49.5 million UMTA investment creates private investment leverages ratios in the 14:1 to 16:1 range averaged over the nine projects. They run from about 4:1 (Baltimore) to as high as 40:1 (Boston). Even if this attributed leverage were reduced to reflect the fact that UMTA provides only 32 percent of the necessary public funding, the private investment leverage ratios would still fall between 4:1 and 5:1 -- still quite respectable.

o Since at least an additional $930 million private investment "within three blocks" of the project sites is said by grant applicants to be "triggered" by the projects, UMTA's true leverage on private investment might even be considered twice as great.

Other Costs

In addition to the public and private capital costs required to construct the nine projects that are the subject of this research, other "costs" include those associated with possible traffic and transit disruptions during project construction, the displacement and sometimes relocation of pre-existing development on the project site, and the possible need to provide additional transit to accomodate the increased transit ridership to the completed projects.

In a definitive assessment of project benefits and costs, such indirect costs (as well as certain indirect benefits such as transportation energy savings, improved air quality due to greater transit usage, reduced off-street parking

requirements, and so forth) should certainly be accounted for. In this preliminary review, such a complete assessment is not deemed necessary (and would be impossible, in any case) in order to draw useful conclusions.

However, it should be acknowledged that of the costs (and benefits) omitted from this report, the hardest to assess would probably be that associated with possibly having to schedule additional transit service to accomodate transit tripmakers at joint development sites. Several questions would need to be answered before determining what costs, if any, should be charged against a project on this score. These questions can become fairly complex:

o Theoretically, it can be argued that most urban transit systems have sufficient "excess capacity" during off-peak periods to absorb substantial ridership increases without putting on added service -- and this may be true even during peak periods in many instances. In a practical analysis it would be necessary to determine, probably through extensive field observations, whether there really was such excess transit system capacity, and whether it existed at the right time and on the right routes in order to accomodate the joint development related ridership.

o Then <u>if</u> additional transit service seemed necessary, there would remain the question of how much of its cost should be charged to the joint development ridership. The added equipment would serve not only that ridership, but ridership throughout the system. The latter, non-project-related, ridership might be great enough to pay for the added service entirely. Again, in a practical analysis it would be necessary to determine, probably through additional field observations, the relative proportions of project-related and non-project-related ridership in order properly to apportion the cost of the added transit service.

This kind of examination was well beyond the scope of the present research. It can be speculated, however, that among the subject projects perhaps only those in Philadelphia and Cambridge might require the scheduling of added service. Whether that added service would also require the acquisition of additonal rolling stock is yet another question that would have to be analyzed. In the opinion of the researcher, these unanswered questions about the cost of possibly-needed additional transit service to accomodate joint development transit ridership do not seriously detract from the finding that joint development projects represent an outstanding way to strengthen urban transit systems.

A Success "Formula"

Identifying the Most Successful Projects

It would be useful to define various "formulae" by which the overall success of a joint development project -- the degree to which it meets the objectives of all participants -- could be quantified both before and after its completion. Success is a relative term, however, and can be defined in many ways. The intent of this research is only to suggest some highly simplified indicators by which involved transit operators and UMTA can anticipate the relative success of projects in which they may participate.

Such indicators must necessarily be based on information that can be assembled at the time an UMTA grant application is made. Although it would probably be possible to develop any number of fairly sophisticated formulae that might appeal to businessmen, developers, elected officials, academicians, or others -- each addressing the special concerns of such diverse groups -- many simply might not bear on the prime interests of transit operators and UMTA, namely, the projected transit ridership and farebox revenues to be associated with proposed joint development projects. Nor might such formulae be particularly meaningful in advance of project completion, because they would likely depend on information only subsequently available.

To avoid the larger, most costly joint development projects always appearing to be the best UMTA investment -- since they will invariably create the largest gross numbers of new transit riders -- it immediately proves convenient to normalize any success indicators as a function of that investment: this was done previously in the preparation of Tables 5 and 6, where ridership and farebox revenues were expressed as ratios per $1,000 UMTA investment. There would probably be merit in requiring grant applicants to provide estimated ridership for at least two points in time, for the first full year following project completion, and again for, say, ten years later.

The longer-term estimate might introduce two additional factors into any success formula: (1) it should give added

credit to projects that propose the possibility of continuing on-site development, such as by adding to building heights, converting part of an outdoor plaza to a new building, and so forth; by holding promise for the future expansion of on-site activity, such projects also hold promise for increasing transit ridership and farebox revenues -- something which obviously "one-shot" projects do not, and (2) it should also give added credit to projects in cities that are commited to making substantial transit system improvements well after joint development projects are completed; such improvements could make those projects even more accessible to the traveling public, and therefore again increase transit ridership and farebox revenues -- something which would not occur in cities where transit service was seen as static or even contracting in the years following project completion. UMTA's review of competing grant applications would still place primary emphasis on initial-year ridership and revenues estimates, but would give due consideration to longer-term prospects.

Although transit ridership and farebox revenue estimates for two points in time, normalized as a function of UMTA investment, are perhaps an adequate success formula in themselves, the potential returns accruing to transit operators from the sale or lease of joint development property, and from sharing in the net increase in property taxes, and perhaps other locally-imposed taxes, cannot be ignored. While reasons have been advanced why actual proceeds are extremely difficult to estimate at the time of grant application, it should certainly be possible for transit operators to negotiate some <u>percentage bases</u> for sharing in them, and to make these percentage bases a part of joint development grant applications. All other things being equal, UMTA might then naturally favor those applications showing the higher percentage sharing bases.

Finally, in view of the troubled economy, and the possibility that high unemployment rates may persist for some time into the future, another component of a success formula might be the number of new permanent jobs created by joint development projects. In assessing this factor, consideration would have to be afforded to employment conditions in each city applying for a project grant. Project-related permanent <u>and temporary</u> employment would obviously mean more to a city with chronically high unemployment than to another city with only a passing problem.

If all of these factors are legitimate indicators in a success formula, what weights should each be given? What is the relative importance to be attached to induced net

additional ridership, induced net additional farebox revenues, percentage sharing in sale/lease and property tax proceeds, and new jobs created? Basically, such "weighting" involves matters of policy, and cannot be settled here in a strictly technical sense. Although the present research involved some games-playing with variously-weighted combinations of factors (including some not discussed in this report), for simplicity and directness, the one success indicator of greatest importance appears to be induced net additional ridership per $1,000 UMTA investment. This indicator can give both UMTA and transit operators perhaps the best available evidence of the possible cost-effectiveness of their proposed investments in joint development projects, and, as such, should be helpful to them in negotiating appropriate value capture percentage sharing agreements.

Comparisons to Other UMTA Investments

How cost-effective is the $49.5 million UMTA investment in the subject joint development projects as compared to other prospective UMTA investments in the construction of new rapid transit systems, extensions of existing systems, or the purchase of new buses or subway cars? One simple, order-of-magnitude assessment can be made by comparing the actual or proposed UMTA investment per daily or annual net additional rider for joint development versus more conventional transit system improvement projects (this is simply the corallary of riders per dollar of investment, as previously used in this report).

Ideally, such a comparison might include both UMTA capital and operating assistance funding, annualizing both types of investment over, say, 20 to 30 years. The comparisons reported here, however, are based only on the actual or estimated capital costs of the joint development and system improvement projects, and the actual or estimated net additional transit ridership attributable to them as of their completion dates. There are at least two reasons why this more simplified comparison probably understates the investment superiority of joint development projects:

o The annualized capital cost of a major transit system improvement, such as a new or extended rapid transit system, is often less than its annual operating costs. Assuming that UMTA continues to share some portion of that annual operating cost beyond 1985, UMTA's real investment per daily net

additional transit trip in major projects might, in fact, be much greater than reported in the comparisons subsequently presented in this report. Since there are no comparable operating costs associated with joint development projects (discounting the possibility that some projects might require additional transit service to accomodate new transit trips, and that that service was really "chargeable" to the joint development project), the omission of operating costs from the comparisons may make system improvement projects seem relatively more cost-effective than they really are.

TABLE 9

ESTIMATED UMTA COST PER NET ADDITIONAL DAILY TRANSIT TRIP TO NINE JOINT DEVELOPMENT PROJECTS

City	Range of Net Additional Transit Trips	UMTA Cost Per Added Trip (Dollars)*
Baltimore	3,337 - 7,310	1,710 - 3,746
Boston	2,418 - 5,302	566 - 1,241
Buffalo	1,644 - 3,606	1,886 - 4,136
Cambridge	5,819 - 12,759	627 - 1,375
Cedar Rapids	281 - 616	1,136 - 2,491
Davenport	450 - 985	711 - 1,556
Miami	1,355 - 2,970	2,323 - 5,092
Philadelphia	7,093 - 15,553	657 - 1,438
Santa Ana	117 - 256	2,734 - 5,983
Totals	22,514 - 49,357	1,003 - 2,199

* Range of additional trips divided by the UMTA grant shown in Table 5.

o UMTA capital assistance grants for major system improvement projects are often phased over many years, that is, a series of grants are made, for example, to support the incremental construction of a new rapid transit system. Initial capital cost estimates are necessarily adjusted upwards over that time period to account for inflation effects. Looking at the initial capital cost per new transit trip added, as in several of the comparisons made following, tends therefore to understate the true capital cost per new transit trip added for a completed system improvement. This is not the case with joint development projects usually involving only a one-time UMTA grant.

Table 9 shows the minimum to maximum cost range in terms of UMTA's capital contribution (in 1979-1980 dollars) per net additional transit trip added as a result of the nine joint development projects. The minimum cost corresponds to the

most favorable assumptions (as discussed previously) regarding the number of new person trips generated by the projects and their propensity to use transit to reach the joint development projects; the maximum cost corresponds to the least favorable assumptions on these grounds. As will be shown next, even themaximum costs per new transit trip added are significantly less than the comparable cost of adding new transit trips by virtue of investments in new or extended rapid transit systems.

Washington's new METRO rail system might be taken as a first case study of the two types of UMTA investment. According to a Metropolitan Washington Council of Governments report, The First Four Years of Metrorail: Travel Changes(September 1981), the average daily ridership for that portion of the system opened through 1979 was about 260,000 trips, half rail-only trips and half combination rail-bus trips. Taking the estimated capital cost of that 31-mile segment as somewhere between $2.1 billion and $2.5 billion (the full 101-mile system was estimated in 1979 to cost about $8.2 billion, and that cost has since escalated significantly), the total capital cost per daily rider would be between $8,077 and $9,615. UMTA's cost, assuming an 80 percent share, would be between $6,462 and $7,692 per daily rider. However, 54 percent of the 260,000 trips were reported by actual survey as having previously been made by bus, so that the $2.1 billion to $2.5 billion investment actually generated only about 119,600 net additional daily transit trips, at a cost of between $17,559 and $20,903 per daily rider -- UMTA's share of that cost being between $14,047 and $16,722 per daily rider.

By comparison, Table 9 shows that UMTA's $49.5 million investment in the nine subject joint development projects may create between 22,514 and 49,357 net additional daily transit trips at a cost to UMTA of between $1,003 and $2,199 per daily rider. Even allowing for vagaries in the numbers used, this single comparison suggests, at worst, a nearly eight-fold advantage, and, at best, an almost fourteen-fold advantage to UMTA investment in joint development projects as against the construction of this particular new rapid transit system. The advantage would look even greater if UMTA's share of rapid transit system operating costs were included in the equation.

Atlanta's new MARTA rail system provides another example. According to the Atlanta Regional Commission's report, Transit Impact Monitoring Program: Results of Station Area Studies(August 1981), in mid-1980 the East-West line averaged about 80,000 riders daily. Taking the estimated capital cost of that initial segment as between $700 million and $800 million (the full 53-mile system estimated to cost $3.4 billion in 1979 dollars), the capital cost per daily rider is

between $8,765 and $10,000. UMTA's share, again assuming an 80 percent match, would be between $7,000 and $8,000 per rider. But with an estimated net additional ridership of only half the 80,000 total ridership, those costs double, to between $14,000 and $16,000 per daily rider. Like the Washington METROrail example, this is eight to fourteen times the cost of the net additional daily transit tripmaking espected to be induced by the nine joint development projects.

Similar comparisons can be made using capital cost and ridership estimates for various proposed transit system improvement projects from different parts of the nation. Figures submitted with capital grant applications and accompanying environmental impact assessments, as summarized in UMTA "decision memoranda" during the last two years, show the following range of expected UMTA costs per net additional daily transit trip served:

o Of several fixed guideway alternatives considered for Houston's "Southwest Corridor," an exclusive busway may be the most cost-effective at about $19,000 pe new rider. Two different versions of a light rail rapid transit (LRT) line would cost $30,000 and $31,000 per new rider, respectively. A heavy rail line would cost about $27,000 per new rider.

o Out of ten alternatives considered for inclusion in a two-corridor, freeway-related system in Sacramento, including both rail and bus options, a set of high occupancy vehicle (HOV) alternatives, and a TSM option that would more than double the bus fleet, the locally preferred $118 million LRT system would add but 1,000 net additional daily transit trips, at a cost of $118,000 per new rider.

o Of various alternatives studied for Los Angeles' "Wilshire Boulevard Corridor," five versions of a rail rapid transit line would all cost between about $5,000 and $8,000 per new rider.

o Of some fourteen alternatives considered for San Jose's "Guadalupe Corridor," including an HOV-way, LRT and commuter rail, the least expensive appears to be the HOV-way at about $1,600 per new rider. A combination expressway/LRT would cost about $3,300 per new rider. Commuter rail would cost about $6,300 per new rider.

o An express bus alternative for Boston's "North Shore Corridor," including certain other system improvements, would generate 524 net additional daily transit trips at a total cost of about $3 million, or about $4,400 per new rider.

All of these indicated costs per net additional daily transit trip are consistently, and usually significantly,

higher than the comparable costs of UMTA investment in the nine subject joint development projects.

This is certainly not to say that all joint development projects are more cost-effective from an UMTA investment standpoint than are all major transit system improvement projects. The examples cited do not purport to prove that general thesis. However, they are certainly strong evidence that joint development projects of the nature examined in this report are a surprisingly cost-effective means of bolstering transit system ridership and farebox revenues. This should be grounds, it seems, for an UMTA policy more explicitly encouraging transit operators to utilize available Section 3 capital assistance grant funds for joint development ventures.

Complete information with which to make comparisons of the cost-effectiveness of UMTA participation in joint development projects versus the acquisition of new rolling stock, particularly for replacements and/or additions to existing bus fleets, is not readily available. Some would argue that in cities with stable or declining bus systems, the replacement of older buses with newer buses may do relatively little to attract additional patrons, but, rather, that such replacement is usually for the purpose of maintaining existing patronage, if possible; in any event, anything less than a significant increase in patronage would produce a very high UMTA investment cost per new rider. In cities where buses (or rail cars) are purchased to meet the needs of an expanding transit system, the investments under some circumstances are probably cost-effective; unfortunately, no reports were found in the literature identifying the number of new transit system riders that could be credited to any such purchases, and thus no cost-per-new-rider comparisons can be made.

In summary it appears that, on average, UMTA's investment in the nine subject joint development projects is significantly more cost-effective than its investment in the Washington and Atlanta rapid transit systems, is even more cost-effective than its possible investment in several other proposed major transit system improvements, and is probably at least as cost-effective as its investments in new buses and rail cars. The better of the nine joint development projects are on the order of ten to twenty times more cost-effective than some of the proposed transit system improvement investments.

Thus it appears that UMTA and transit operator participation in joint development projects holds promise of substantial financial payoffs. Experience with a growing number of successful projects seems to have allayed the concerns of most transit operators and real estate

developers, and a new UMTA program favoring such private sector-public sector partnerships would seem timely. Such a program should rest on explicit UMTA policy recognizing the relative advantages of joint development projects as an effective means of utilizing UMTA Section capital assistance funds to improve urban transit systems and to make them more financially viable.

Evaluating Future Joint Development Project Applications

Drawing on findings from throughout this report, the following suggestions are made relative to improving UMTA procedures for selecting the most potentially successful joint development projects from among competing future grant applications. Many of the procedural improvements relate to placing more stringent requirements on grant applicants to furnish more complete information. In the researcher's opinion, UMTA should:

o Look for projects that yield the best net additional transit system ridership per dollar of UMTA investment. The experience so far indicates that these are apt to be the larger projects in terms of total floor space, but there is no reason that smaller projects cannot also be successful, providing UMTA's investment in them is commensurate with their size.

o Look for projects with significant proportions of office or retail floor space, the latter preferably devoted to major department stores providing shopper rather than convenience goods, since trip generation rates for shopper goods tend to be higher. Retail establishments of all types are a desired activity, however, because they create more off-peak tripmaking than do many other activities, and thus can take advantage of "excess capacity" in the transit system during off-peak hours.

o Avoid projects with large proportions of floor space devoted to residential uses, hotels, and other activities that are relatively low transit trip generators. Second to retail establishments, the most desired activity would be general offices. Most types of government-related, or "public," offices would be more desirable than "private" corporate and business offices, because they tend to attract more visitor trips and thus have higher total trip generation rates.

o Look for any evidence that the equivalent of the floor space activity proposed for a joint development site might

otherwise occur outside the central business district of the applicant city (letters to that effect from potential developers and tenants would be helpful). Higher priority might then be given to such projects than to other projects where the equivalent activity might be supposed to occur within the central business district (and thus help to support the transit system) in any event.

o Require that applicants follow person trip generation, modal split, and farebox estimation techniques published by, or acceptable to, the UMTA. Require that applicants submit estimated ridership and farebox revenues as of project completion date, and, say, ten years later. Require that pertinent calculations and data sources be included in applications, and that ridership and farebox revenue information be presented both for peak/off-peak and daily/annual time periods.

o Require that any significant change in project scope, such as the substitution of activities with greatly different trip generation rates for those activities initially proposed, or a major alteration of total floor space, be reported promptly to UMTA, along with revised ridership and farebox revenue estimates.

o Require a discussion in the grant application of the amount of "excess capacity" in the transit system serving the proposed project, and an estimate of the possible cost, if any, of providing additional transit service to the project site. Projects in areas with greater "excess capacity" would naturally be preferred to those in areas with less.

o Require that a specific percentage of annual lease/sale proceeds, say one or two percent, or whatever is agreed upon as reasonable and realistic, be payable directly to the participating transit operator.

o Require, similarly, that a specific percentage of annual property tax proceeds on the joint development, again say one or two percent, or whatever is agreed upon as reasonable and realistic, be paid directly to the participating transit operator.

o Require that the grant applicant "guarantee" that combined lease/sale and property tax proceeds be at least sufficient to "repay" the combined UMTA and transit operator investment within not more than ten years.

o Look for an UMTA-to-private investment leverage ratio of at least 10:1, and the higher the better.

o Look for assurances that developers and tenants will actively encourage transit usage by employees, shoppers, and

visitors through employer- and merchant-based transit pass programs, shopper fare-reduction programs, and comparable promotional methods.

o Look for assurances that developers and tenants will agree to utilize alternative work schedules to the maximum extent feasible to ease any peak-period transit system crowding that might develop in the vicinity of projects upon their completion.

o Look for assurances that off-street parking does not exceed the minimum allowable under local zoning ordinances. Preference would be given to projects having no associated off-street parking.

o Prefer projects undertaken in conjunction with the initial construction of rapid transit stations and other transit terminals to projects involving the renovation or reconstruction of existing stations and terminals, on grounds of general cost economy.

At this point in time, there is little quantitative information available to transit operators to assist them in formulating benefit-sharing approaches and arriving at reasonable charges or other contributions in return for the market and locational adavantages provided through joint development projects to real estate developers and others. There is clearly a need to assemble (1) information about existing practices, (2) insights into the development process, (3) guidance in relating to private and public sector beneficiaries, and (4) strategies for negotiating benefit-sharing. [Editor's note: the UMTA-funded National Cooperative Transit Research and Development Program is currently undertaking a research project on this subject.]

APPENDIX A: TRIP GENERATION PROCEDURES

It was deemed necessary in the preparation of this report to recompute the daily and annual transit ridership credited to the completion of the subject joint development projects by the various applicants for UMTA funding under the former Urban Initiatives Program. As a consequence, it was also necessary to recompute the projected daily and annual farebox revenues found in the applications. Since these numbers are basic to some of the conclusions of this report, it is essential to describe the principal assumptions and procedures used in making such recomputations. While several reasons for the re-estimation of ridership and farebox revenues were given in the main text, some additional points can be made here to support that reasoning:

1. Ridership and revenue data, as contained in the applications, were not only derived from various and inconsistent trip generation source material, but most calculations were also poorly documented and poorly explained as well. To some extent, this was not surprising. First, there were evidently some time pressures in the preparation and submission of grant applications to UMTA, probably created by a feeling of first-in, first-out competition for those grants. Second, applications appear to have been generally prepared and submitted by various development agencies. These agencies stressed what they knew most about: project descriptions, area demographics, tax structures, jobs created, and so forth; they often paid much less attention to such seemingly routine information as projected transit ridership and farebox revenues. Although transit operators undoubtedly provided reasonably detailed information on this subject, it was obvious in some instances that only parts of that information was actually included in the applications, and sometimes only in a generalized manner, such as by stating that "the joint development project will attract upwards of 15,000 new transit riders a day." Recalculating trip generation according to standard trip rates associated with generalized land use activities, regardless of whether the resulting transit ridership estimates are arguably too high or too low, allows project-to-project comparisons to be made on a consistent basis that can be fully and easily explained.

2. Ridership and revenue estimates did not, however, appear

to be exaggerated in order to make projects look better than they might really be. If anything, those estimates seemed to be conservative, that is, to understate the potential ridership and revenue returns. For example, office building transit trip generation consistently ignored office visitor trips that, according to some researchers, can add one at least one trip for every three office work trips (see Urban Travel Patterns for Hospitals, Universities, Office Buildings and State Capitols, Louis E. Keefer and Associates, National Cooperative Highway Research Program, Report No. 62, Highway Research Board, Washington, DC, 1969). Office building transit trip generation also appears to have ignored lunchtime office worker trips for eating and shopping. It is known, for example, that 51 percent of all workers employed near the East-West Rapid Transit Line in Atlanta make one or more round trips from their workplaces during their workday; about 15 percent make two or more such round trips during the day; and a substantial portion of all such trips are made by transit (see Results of the 1980 Workplace Survey in the East-West Line Corridor, Transit Monitoring Program, Atlanta Regional Commission, Atlanta, GA, June 1982). To overcome omissions of this sort, and to insure getting more complete and more consistent ridership and farebox revenue information in any future joint development grant applications, UMTA should clearly provide at least general guidelines for applicant preparation of trip generation, modal split, and farebox revenue caluclations, and require that documentation of such calculations be included in the grant applications.

3. Some of the principal differences in the original and the re-estimated ridership and farebox revenue figures stem from changes in the types and quantities of land use activities to be contained in the joint development projects -- some changes coming as much as two years after the UMTA grant applications had been submitted. Since such changes may always be part of joint development planning and implementation, it might serve good purpose from UMTA's standpoint if applicants were required to submit revised ridership and farebox revenue estimates whenever significant changes are anticipated. Some limitations on the extent of changes allowable without some kind of penalty might also be established: for example, if the activity changes should reduce the originally estimated ridership and revenues by, say, more than 20-30 percent, then a certain proportion of the original UMTA grant might have to be repaid by the grantee.

Following, then, are the principal assumptions and procedures that guided the re-estimation of ridership and farebox revenues generated by the nine joint development projects considered in this report. Although some of the assumptions may be questioned, largely on grounds that city-to-city variations in trip generation rates have been ignored, the purpose of the re-estimates has been served as

long as they have "ball-park" validity.

It should be especially noted that the greatest fault of both the original and the re-estimated trip generation figures results from the lack of empiric data on trip generation at joint development projects, per se. Consultation with a number of practitioners failed to disclose any knowledge of field studies taken at completed joint development projects. Because of this lack of data, those concerned with joint development trip generation necessarily must rely on field studies taken at scattered activity sites, largely in suburban settings, that resemble activities found in joint development projects. It can be speculated that trip generation at multi-use joint development projects is probably greater than at the generally single-use sites reported in the trip generation literature. It would seem most useful for UMTA (or others concerned with joint development projects) to sponsor appropriate field studies of person trip generation at completed joint development projects in order to establish improved guidelines for determining transportation needs at such multi-use sites.

Trip Generation Assumptions

1. Offices

o All office buildings privately owned and occupied, that is, no "public buildings," although some public agencies could become tenants in private buildings.

o All offices fully occupied, that is, no vacancies.

o A constant ratio of 200 square feet per employee.

o All employees come to work every day, with no reduction in trip generation for annual and sick leave, out-of-town assignments, or working at home.

o A constant ratio of 0.3 visitor trips (such as salespersons, suppliers, customers, clients, service persons, consultants, family members, business meeting attendees, and so forth) for every employee work trip.

o No employee trips leaving and returning to work during the day, including at lunchtime; this assumption probably more than offsets ignoring the average daily absentee rate.

o Eighty percent (80%) of office work trips made during peak periods (7-9 AM and 4-6 PM), and all visitor trips made during off-peak period hours.

o Modal split based on a combination of information from the applications and from published origin-destination studies of total central business district modal splits.

2. Retail Establishments

o Only two of the joint development projects had major amounts of retail space: Philadelphia and Baltimore. For these, 80 person shopping trips per 1,000 square feet of space were assumed, a rate considered average for regional shopping centers.

o For retail establishments in the remaining projects, a rate of 20 person shopping trips per 1,000 square feet was assumed, more representative of a neighborhood shopping center (and perhaps much too conservative).

o Ninety percent (90%) of all shopping trips made during off-peak period hours.

o A constant ratio of one employee per 1,000 square feet of space, and 80 percent of all work trips made during peak periods of travel.

o A modal split for shopper trips about 10-20 percent lower than for office work trips, but the same modal split for retail workers as for office workers.

3. Hotels

o One "room-related" employee per room, plus half again as many employees in shops, bars, restaurants and related services, including part-time employees needed for conferences, banquets, and other special events.

o A 75 percent average room occupancy rate, with an average of 1.5 persons per occupied room, each making four non-walking trips a day.

o A modal split significantly less than that for other joint development project activities, with all transit trips occuring during off-peak period hours.

4. Residential Units

o All units fully occupied, with an average occupancy of 1.5 persons per room, each averaging four non-walking trips a day.

o A modal split developed judgmentally based partly on the

number of work/shop opportunities within walking distance of the residential development, and partly on the nature of the transit service focused on the project.

These assumptions produced a re-estimated total transit ridership approximately 20 percent greater than found in the original grant applications (see Table A-1). Most re-estimates for individual projects were higher, although several were lower. Because the principal findings of this report are based on aggregate statitistics, the precision of trip generation figures for individual projects was not considered critical to the validity of those findings so long as "resonableness" was maintained.

One such test for reasonableness was to compare the permanent employment estimated in grant applications to the employment derived from assumptions about the number of employees per unit of floor space as used in the trip generation re-estimation process. Where the applications indicated a range of from about 28,000 to 32,000 permanent employees, the trip generation re-estimation process produced an estimated employment of about 29,000. From this and other cross-checks, it was felt that the re-estimation process had not introduced any serious biases.

Farebox Revenue Assumptions

Most of the assumptions made regarding the re-estimation of farebox revenues have been reported in the text of this report. They principally involve choosing (1) different daily-to-annual transit ridership expansion factors for different generalized land use activities (rather than a simple systemwide average factor), and (2) applying present fares to that annual ridership. Again, Table A-1 shows that the re-estimated figures were somewhat higher than those contained in the grant applications: about 37 percent (as compared to a 20 percent higher ridership). Most of this difference in original versus re-estimated farebox revenues can be attributed to fare increases that took effect between the 1979-1980 application period and the 1982 re-estimation analysis. A careful review of the footnotes to Table A-1 suggests additonal reasons for the variance.

APPENDIX B: ADDITIONAL TABLES

TABLE 1A

SUMMARY OF ESTIMATED TRANSIT TRIPS GENERATED

AT NINE JOINT DEVELOPMENT SITES

City and Activity	Square Feet	Average Weekday Trips						Modal Split (%)
		Peak	%	Off-Peak	%	Total	%	
Baltimore								
Office	200,000	960	64	540	36	1,500	100	58
Retail	631,000	740	10	6,660	90	7,400	100	21
Total	831,000	1,700	19	7,200	81	8,900	100	24
Boston								
Office	400,000	2,144	62	1,340	38	3,484	100	67
High-Tech	250,000	1,360	73	510	27	1,870	100	52
Hotel	600,000	600	55	500	45	1,100	100	28
Total	1,250,000	4,104	64	2,350	36	6,454	100	51
Buffalo								
Office	600,000	2,400	70	1,050	30	3,450	100	44
Retail	40,000	60	25	180	75	240	100	27
Hotel	400,000	300	43	400	57	700	100	25
Total	1,040,000	2,760	63	1,630	37	4,390	100	38
Cambridge								
Office	1,450,000	7,772	63	4,527	37	12,299	100	67
Retail	100,000	134	12	1,000	88	1,134	100	52
Hotel	300,000	400	67	200	33	600	100	50
Residential	300,000	670	82	150	18	820	100	68
Light Industry	400,000	428	63	252	37	680	100	67
Total	2,2550,000	9,404	61	6,129	39	15,533	100	65
Cedar Rapids								
Office	160,000	360	60	240	40	600	100	30
Retail	15,000	10	10	90	90	100	100	30
Residential	40,000	20	40	30	60	50	100	25
Total	215,000	390	52	360	48	750	100	28
Davenport								
Community College	30,000	222	22	768	78	990	100	40
Hotel	250,000	135	64	75	36	210	100	40
Total	280,000	357	30	843	70	1,200	100	38
Miami								
Office	200,000	640	65	340	35	980	100	38
Retail	60,000	48	3	1,440	97	1,488	100	30
Hotel	200,000	80	23	270	77	350	100	24
Residential	670,000	400	50	400	50	800	100	20
Total	1,130,000	1,168	32	2,450	68	3,618	100	20

TABLE 1A Continued

Philadelphia								
Office	1,550,000	8,680	66	4,495	34	13,175	100	65
Retail	800,000	1,472	26	4,288	74	5,760	100	72
Total	2,350,000	10,152	54	8,783	46	18,935	100	67
Santa Ana								
Office	70,000	192	62	120	38	312	100	30
Total	70,000	192	62	120	38	312	100	30
All Cities								
Office	4,630,000	23,148	65	12,652	35	35,800	100	60
Retail	1,646,000	2,464	15	13,658	85	16,122	100	32
High-Tech	250,000	1,360	73	510	27	1,870	100	52
Light Industry	400,000	428	63	252	37	680	100	67
Hotel	1,750,000	1,515	51	1,445	49	2,960	100	29
Residential	1,010,000	1,090	65	580	35	1,670	100	31
Community College	30,000	222	22	718	78	990	100	40
Grand Total	9,716,000	30,227	50	29,865	50	60,092	100	45

TABLE 2A

SUMMARY OF ESTIMATED NET ADDITIONAL TRANSIT

TRIPS GENERATED AT NINE JOINT DEVELOPMENT SITES

City and Activity	Range of Average Weekday Trips Generated				
	Peak Period	%	Off-Peak Period	%	Total
Baltimore					
Office	360- 788	64	202- 444	36	562-1232
Retail	278- 608	10	2497-5470	90	2775-6078
Total	638-1396	19	2699-5914	81	3337-7310
Boston					
Office	809-1774	62	496-1088	38	1305-2862
High-Tech	512-1121	73	189- 415	27	701-1536
Hotel	227- 497	55	185- 407	45	412- 904
Total	1548-3392	64	870-1910	36	2418-5302
Buffalo					
Office	904-1984	70	388- 850	30	1292-2834
Retail	23- 49	25	67- 148	75	90- 197
Hotel	113- 247	43	149- 328	57	262- 575
Total	1040-2280	63	604-1326	37	1644-3606
Cambridge					
Office	2902-6364	63	1705-3738	37	4607-10102
Retail	51- 112	12	374- 819	88	425- 931
Hotel	150- 330	67	75- 163	33	225- 493
Residential	252- 553	82	55- 121	18	307- 674
Light Industry	161- 352	63	94- 207	37	255- 559
Total	3516-7711	61	2303-5048	39	5819-12759
Cedar Rapids					
Office	135- 296	60	90- 197	40	225- 493
Retail	4- 8	10	33- 74	90	37- 82
Residential	8- 16	40	11- 25	60	19- 41
Total	147- 320	52	134- 296	48	281- 616
Davenport					
Community College	82- 179	22	289- 634	78	371- 813
Hotel	51- 110	64	28- 62	36	79- 172
Total	133- 289	30	317- 696	70	450- 985
Miami					
Office	239- 523	65	128- 281	35	367- 804
Retail	17- 37	3	540-1185	97	557-1222
Hotel	30- 66	23	101- 221	77	131- 287
Residential	150- 329	50	150- 328	50	300- 657
Total	436- 955	32	919-2015	68	1355-2970

TABLE 2A Continued

Philadelphia					
Office	3257-7143	66	1678-3679	34	4935-10822
Retail	561-1230	26	1597-3501	74	2158-4731
Total	3818-8373	54	3275-7180	46	7093-15553
Santa Ana					
Office	73- 159	62	44- 97	38	117- 256
Total	73- 159	62	44- 97	38	117- 256
All Cities	11349-24875	50	11165-24482	50	22514-49357

TABLE 3A

SUMMARY OF ESTIMATED FAREBOX REVENUES FROM TRANSIT TRIPS

GENERATED AT NINE JOINT DEVELOPMENT SITES ($)

Project City	Type of Activity						All Activities
	Office	Retail	LI/HT	Hotel	Res'd	Coll	
Baltimore							
D	975	4,440					5,415
A	243,750	1,420,800					1,664,550
Boston							
D	2,004		1,075	633			3,712
A	501,000		290,250	202,250			993,810
Buffalo							
D	1,898	120		350			2,368
A	474,500	38,400		112,000			624,900
Cambridge							
D	7,072	653	391	345	472		8,933
A	1,768,000	208,960	105,570	110,400	141,600		2,334,530
Cedar Rapids							
D	180	30			15		225
A	45,000	9,600			4,500		59,100
Davenport							
D				63		297	360
A				20,160		89,100	109,260
Miami							
D	490	744		175	400		1,809
A	122,500	288,080		56,000	120,000		536,580
Philadlephia							
D	14,045	4,735					18,780
A	3,511,250	1,515,200					5,026,450
Santa Ana							
D	225						225
A	56,250						56,250
All Cities							
D	26,889	10,722	1,466	1,566	887	297	41,827
A	6,722,250	3,431,040	395,820	501,120	266,100	89,100	11,405,430
Percent of Revenues	58.9	30.1	3.5	4.4	2.3	0.8	100.0

D = daily
A = annual

TABLE 4A

SUMMARY OF ESTIMATED FAREBOX REVENUES FROM NET ADDITIONAL TRANSIT TRIPS GENERATED AT NINE JOINT DEVELOPMENT SITES

Project City	Range of Farebox Revenues Generated ($)	
	Average Weekday	Annual
Baltimore	2,028 - 4,448	623,540 - 1,367,261
Boston	1,390 - 3,049	372,281 - 816,316
Buffalo	887 - 1,945	234,088 - 513,293
Cambridge	3,346 - 7,338	874,515 - 1,917,583
Cedar Rapids	84 - 185	22,139 - 48,545
Davenport	135 - 295	40,929 - 89,746
Miami	678 - 1,486	201,003 - 440,747
Philadelphia	7,034 - 15,426	1,882,908 - 4,128,726
Santa Ana	84 - 185	21,071 - 46,204
All Cities	15,666 - 34,457	4,272,474 - 9,368,421

TABLE 5A

ANNUAL AND DAILY INDUCED RIDERSHIP AND FAREBOX REVENUES

PER THOUSAND DOLLARS OF UMTA GRANT[a]

Project	UMTA Grant (millions)	Ridership		Farebox Revenues	
		Daily/$1000 UMTA grant	Annual/$1000 UMTA grant	Daily/$1000 UMTA grant	Annual/$1000 UMTA grant
Baltimore	12.5	0.7	219	$0.43	$133.16
Boston	3.0	2.2	576	1.24	331.27
Buffalo	6.8	0.6	171	0.35	91.90
Cambridge	8.0	1.9	507	1.12	291.81
Cedar Rapids	0.7	1.1	281	0.32	80.35
Davenport	0.7	1.7	520	0.51	156.09
Miami	6.9	0.5	156	0.26	77.77
Philadelphia	10.2	1.9	504	1.84	492.79
Santa Ana	0.7	0.4	111	0.32	80.35
All Cities (weighted)	49.5	1.2	300	$0.85	$230.88

a Exclusive of UMTA investment in associated transit system improvements.

TABLE 6A

NET ADDITIONAL ANNUAL AND DAILY RIDERSHIP AND

FAREBOX REVENUES PER THOUSAND DOLLARS OF UMTA GRANT[a]

Project	Ridership		Farebox Revenues	
	Daily/$1000 UMTA grant	Annual/$1000 UMTA grant	Daily/$1000 UMTA grant	Annual/$1000 UMTA grant
Baltimore	0.3 - 0.6	82 - 180	$0.16 - 0.35	$50 - 109
Boston	0.8 - 1.8	215 - 473	0.46 - 1.02	124 - 272
Buffalo	0.2 - 0.5	64 - 140	0.13 - 0.29	34 - 75
Cambridge	0.7 - 1.6	190 - 416	0.42 - 0.92	109 - 240
Cedar Rapids	0.4 - 0.9	120 - 230	0.12 - 0.26	30 - 66
Davenport	0.6 - 1.4	192 - 427	0.19 - 0.42	58 - 128
Miami	0.2 - 0.4	58 - 128	0.10 - 0.21	29 - 64
Philadelphia	0.7 - 1.6	189 - 414	0.69 - 1.51	185 - 405
Santa Ana	0.2 - 0.3	41 - 91	0.12 - 0.26	30 - 66
All Cities (weighted)	0.4 - 1.0	81 - 246	$0.31 - 0.70	$85 - 190

a Exclusive of UMTA investment in associated transit system improvements.

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The literature on joint development is extensive and growing. The following represent some major references that the reader may find useful for further study. No attempt is made to be definitive, and the listing does not imply that each reference was consulted in the conduct of the present research.

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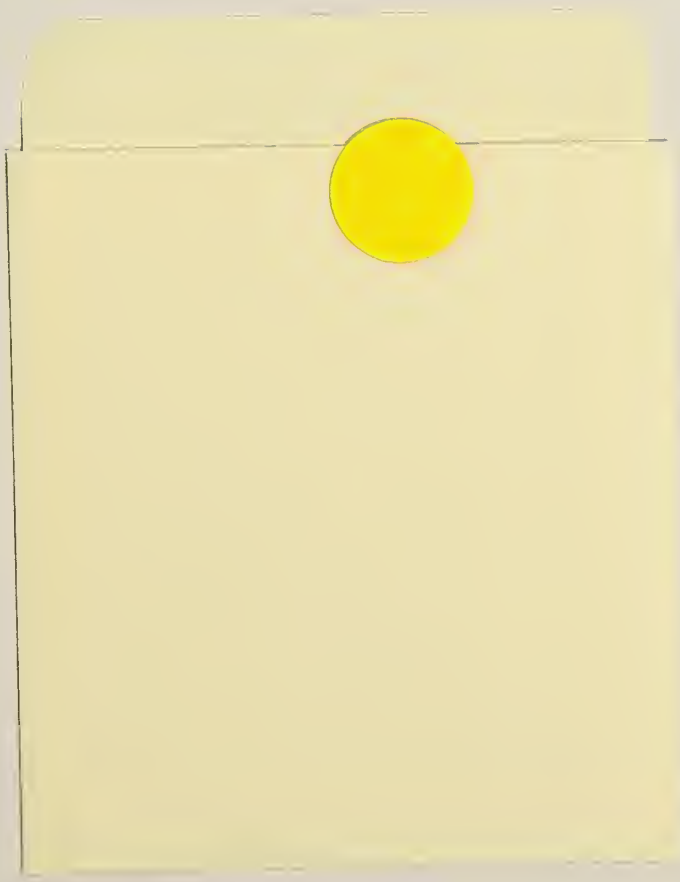

NOTICE

DOT-I-83-46

TECHNOLOGY SHARING

SPECIAL STUDIES IN TRANSPORTATION PLANNING (SSTP)

PROGRAMS OF THE U.S. DEPARTMENT OF TRANSPORTATION